Shaughnessy No.: 128501

Date Out of EAB: JUN 30 1986

To: R. Taylor
Product Manager 25
Registration Division (TS-767)

From: Samuel Creeger, Chief
Review Section #1
Exposure Assessment Branch
Hazard Evaluation Division (TS-769)

Attached, please find the EAB review of...

Reg./File # : 476-EUP-RNE, 476-EUP-RNG, 476-EEEL, 476-EEEA

Chemical Name: Sulfosate

Type Product : Herbicide

Product Name : SC-0224

Company Name : Stauffer

Purpose : Data submission for 2 EUP's and 2 Sec. 3 Registrations

Action Code(s): 701, 121

EAB #(s) : 6483 - 6486

Date Received: 3/31/86

TAIS Code: _____

Date Completed: JUN 30 1986

Total Reviewing Time: 3 days

Deferrals to: _____ Ecological Effects Branch

_____ Residue Chemistry Branch

_____ Toxicology Branch

Monitoring study requested by EAB: _____

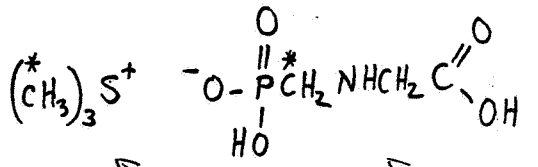
Monitoring study voluntarily conducted by registrant: _____

1. CHEMICAL: Common name: Sulfosate

Trade names: SC-0224; R-50224

Chemical name: Trimethylsulfonium carboxymethylamino-methylphosphonate

Structure:



*Site of radiolabeling TMS CMAMP

2. TEST MATERIAL: See individual studies.

3. STUDY/ACTION TYPE: Aerobic metabolism studies.

4. STUDY IDENTIFICATION:

McBain, J.B., Metabolism of SC-0224 in Soil: Fate of the Trimethylsulfonium Moiety. Stauffer Chemical Co. Report No. PMS-179. 12/20/85. EPA Acc. No. 260670.

McBain, J.B. Metabolism of SC-0224 in Soil: Fate of the Carboxymethylaminomethylphosphonate Moiety. Stauffer Chemical Co. Report No. PMS-186 EPA Acc. No. 260670.

5. REVIEWED BY:

Stephen J. Simko
Chemist
EAB/HED/OPP

Signature: S. Simko 6/30/86

6. APPROVED BY:

Samuel M. Creeger
Chief, Section 1
EAB/HED/OPP

Signature: Sam L. M Creeger JUN 30 1986

7. CONCLUSIONS:

The first report (using sulfosate radiolabeled only on the TMS portion) demonstrates that TMS has a half-life of about 3 days in soil and that CO_2 is the major degradate. However, an unknown of approximately 14% of the applied and a recovery of 73% at the end of the study represent gaps in the understanding of the fate of TMS. Soil bound ^{14}C residues peaked at about 20% of the applied at day 8 and then slowly decreased.

Extractable ^{14}C declined from about 60% of the initial level applied at day 0 to approximately 6% at day 10 (most of which was parent TMS). During the first week approximately 50% of the applied radioactivity was trapped in the NaOH traps as $^{14}CO_2$. After 211 days, 75% of the applied ^{14}C was recovered from the NaOH traps. Recoveries ranged from 73% to 87% of the ^{14}C initially applied. Small scale studies, which had different temperature conditions from the large study, were used to identify the ^{14}C residues. In the small scale studies, most of the extractable ^{14}C residues (declining from 75.3% of the applied at day 0 to 27.1% at day 4) were recovered from the ammonium formate fraction and it was found to contain only parent TMS. The acetone fraction contained about 0.5% TMS over the same time period, but also contained an unknown ^{14}C residue that peaked at 14-17% of the applied ^{14}C at 4 days and declined to about 1% of the applied at 6 days. Recoveries from the small scale studies were improved during the first two days indicating that combustion of wet soils (as opposed to dry soils in the large study) gave a more accurate determination.

In the second report (using sulfosate radiolabeled only on the CMAMP portion), the CMAMP half-life was determined to be approximately 2-3 days. In the study the extractable residues declined from about 57% of the applied at day 0 to 14% at day 30. Soil bound residues were 40% of the applied initially and declined to 18% at day 30. At day 30 about 60% of the applied was detected as CO_2. No ^{14}C was detected in the foam plugs. Recovery was 91 - 102% for the one year duration of the study. Identification of residues was made in a small scale study and showed CMAMP comprised 78% of the applied at day 0 (97% of the extractable residues) and 8% at day 21. The degradate aminomethylphosphonate (AMP) comprised 0.4% of the applied at day 0 and 15.4% (57% of the extractable residues) at day 21. The extractable ^{14}C residues from the large study declined from 30% of the applied at day 9 to 14% at day 30 and 8% at day 76 indicating that AMP probably increased slightly after day 21 for a short period and then decreased following the rate of decline of the ^{14}C extractable residues (qualitative determinations were not made after day 21).

8. RECOMMENDATIONS:

The aerobic soil metabolism data requirement is satisfied by the studies submitted for this review. In addition, the requested experimental program state distribution of target sites/amounts to be applied for the 4LC was submitted with this review and is appended. EAB normally cannot recommend granting an EUP until an adequate aged leaching study is submitted and reviewed. However, based on a partially accepted field study evaluated in the 1/17/86 EAB review which shows aminomethylphosphonic acid (the major soil degradation product) to have little leaching potential, the need for an aged leaching study can be waived for this EUP only. For Registration of sulfosate, adequate studies must be submitted for the following categories (refer to the 1/21/86 EAB review):

Photodegradaton on soil: Experimental details are needed as indicated in EAB review of 1/21/86.

Anaerobic aquatic metabolism

Aged Leaching

Terrestrial field dissipation: Experimental details are needed as indicated in EAB review of 1/17/86 and additional studies as indicated in EAB review of 1/21/86.

Forestry dissipation study

9. BACKGROUND:

The submissions in this review were in support of EUP and Sec (3) Registrations for use of sulfosate for weed control to a variety of non-crop areas. See EAB review of 8/18/83 for the experimental program for the concentrate and 4LC. The detailed state distribution of target sites/amounts to be applied for the 4LC was submitted with this review and is appended. Also refer to previous EAB reviews dated 1/17/86 and 1/21/86.

10. DISCUSSION OF INDIVIDUAL TESTS OR STUDIES:

10.1 Study Identification

McBain, J.B., Metabolism of SC-0224 in Soil: Fate of the Trimethylsulfonium Moiety. Stauffer Chemical Co. Report No. PMS-179. 12/20/85. EPA Acc. No. 260670.

Materials and Methods

Aerobic metabolism of the trimethylsulfonium (TMS) salt of carboxymethylaminomethylphosphonic acid (CMAMP), which was labeled in the methyl groups of the TMS cation, was studied. A second study which follows this review uses the compound labeled in the CMAMP moiety. Stauffer preparation no. WRC-7293-36 had specific activity of 20 mCi/mmole and a radiopurity of 96.5%; preparation no. WRC-8917-05-02 had a sp. act. of 20 mCi/mmole and a radiopurity of 96%. Two non-radiolabeled Stauffer preparations were also used: WRC-7466-14-01 had 57.04% sulfosate [redacted] by weight; WRC-8289-35-1 had 56.6% sulfosate [redacted]

An air dried (7.7% moisture) Sorrento loam (see tables) was sieved through a 3 mm screen and aliquots of 215.4 g of soil were transferred into each of a series 1000 ml biometer flasks. Each of these were treated at 30 ppm with 10.0 ml of a treatment solution containing 6.0 mg sulfosate and 1.08×10^8 dpm ^{14}C. Sixteen ml of water were then added to adjust soils to field capacity and two flasks were frozen for use as 0-time samples. For each remaining flask 50 ml of 5% NaOH was added to the sidearm CO_2 trap. A polyurethane foam plug was placed in the passage way to the sidearm (to trap volatiles other than CO_2). The flasks were sealed with an oxygen source supplied at a slow rate to maintain aerobic conditions. The flasks were kept in the dark at 23°C constant temperature.

The NaOH traps and the foam plugs were periodically collected, analyzed, and replaced with fresh NaOH and foam plugs. Analysis for $^{14}CO_2$ in the

NaOH traps was by $BaCl_2$ precipitation and by radioassay of the trap samples both before and after $BaCl_2$ treatment. The foam plugs were extracted with ethyl acetate. The ethyl acetate washings were radioassayed. At 1, 6, 10, 17, 24, 31, 45, 60, 74, 88, 125, 168 and 211 days duplicate soil flasks were extracted three times with 1M ammonium formate followed by two extractions with acetone. The extracts and the extracted and air-dried soil were radioassayed by combustion analysis.

A smaller study was conducted to generate sulfosate degradates for characterization and to examine the first days of degradation in detail. The treatment solutions for these smaller studies contained 550,570 dpm/10 ml (study 1), 409,670 dpm/10 ml (study 2a) and 467,100 dpm/10 ml (study 2b). Fifty g samples of air-dried, screened (0.2 mm) Sorrento loam were added to 157.5 ml Wheaton serum bottles into which was placed a small tube containing approximately 4 ml 10% KOH solution. The inner surface of each tube was lined with filter paper to provide additional surface for trapping CO_2. The soils were treated with 1.0 ml of the treatment solution (representing an application rate of 30 ppm) and then 13.0 ml of water were added to adjust the moisture level to field capacity. The bottles were sealed with a continuous supply of oxygen, and kept at ambient temperature that ranged from 18 to 26.7°C each day. Samples were taken through nine days.

KOH traps were radioassayed by LSC. The soil was extracted two times with acetone and then two times with 1.0M ammonium formate. All extracts were radioassayed by LSC and analyzed by various TLC procedures. The residues in the extracted soil (wet soil) were determined by combustion analysis. Confirmation of the presence of TMS in the ammonium formate extracts was made by conversion of TMS to dimethylsulfide (DMS) and determination by GC/MS.

Reported Results

TMS was determined to have a half-life of approximately 3 days (see tables). Soil bound ^{14}C residues peaked at about 20% of the applied at day 8 and then slowly decreased. Extractable ^{14}C declined from about 60% of the initial level applied at day 0 to approximately 6% at day 10 (most of which was parent TMS). During the first week approximately 50% of the applied radioactivity was trapped in the NaOH traps as $^{14}CO_2$. After 211 days, 75% of the applied ^{14}C was recovered from the NaOH traps. No ^{14}C was trapped by the polyurethane foam plugs. Recoveries ranged from 73% to 87% of the ^{14}C initially applied.

The small scale studies, which had different temperature conditions from the large study, were used to identify the ^{14}C residues. Most of the extractable ^{14}C residues (declining from 75.3% of the applied at day 0 to 27.1% at day 4) were recovered from the ammonium formate fraction and it was found to contain only parent TMS. The acetone fraction contained about 0.5% TMS over the same time period, but also contained an unknown ^{14}C residue that peaked at 14-17% of the applied ^{14}C at 4 days and declined to about 1% of the applied at 6 days. Recoveries from the small scale studies were improved during the first two days indicating that combustion of wet soils (as opposed to dry soils in the large study) gave a more accurate determination.

Reviewer's Dicussion and Interpretation of Study Results

This study demonstrates that TMS has a short half-life in soil and that CO_2 is the major degradate. However, an unknown of approximately 14% of the applied and a recovery of 73% at the end of the large study represent gaps in the understanding of the fate of TMS. The study authors attempted to resolve these gaps. It was concluded that the gap in the recovery was due to degradation to methane which could not be detected by the experimental procedure. In the TLC procedure used to determine the unknown acetone residues, 25% to 60% of the radioactivity was lost and corrected for by assuming that all of the lost product was the unknown that was detected in that the procedure. However, this is only an assumption. The physical entry point for oxygen to the system as described in the text was not in agreement with the drawing of the apparatus.

10.2 Study Identification

McBain, J.B. Metabolism of SC-0224 in Soil: Fate of the Carboxymethylaminomethylphosphonate Moiety. Stauffer Chemical Co. Report No. PMS-186 EPA Acc. No. 260670.

Materials and Methods

Aerobic metabolism of the carboxymethylaminomethylphosphonic acid (CMAMP) moiety of sulfosate, which was labeled in the phosphomethyl group, was studied. The previous study in this review tested the TMS moiety. Stauffer preparation no. WRC-7615-29-01 (^{14}C-labeled) had specific activity of 30 mCi/ MMole and a radiopurity of 96.5%; preparation no. WRC-7615-36 (^{13}C-labeled) had a 100 atom % enrichment [redacted] containing 54.4% (w/w) ^{13}C-sulfosate. A non-radiolabeled Stauffer preparation was also used: WRC-7466-14-01 had 59.6% sulfosate [redacted] (95.7% pure [redacted]

An air dried (1.02% moisture) Sorrento loam (see tables) was seived through a 3mm screen and portions of 203.4 g of soil were transferred into each of a series 1000 ml biometer flasks. Each of these were treated with 10.0 ml of a treatment solution containing 6.0 mg sulfosate and 9.73×10^7dpm radiocarbon. Twenty-eight ml of water were then added to adjust soils to field capacity and two flasks were frozen for use as 0-time samples. For each remaining flask 50 ml of 5% NaOH was added to the side arm CO_2 trap. A polyethane foam plug was placed in the passage way to the sidearm trap (to trap volatiles other than CO_2). The flasks were sealed with a oxygen source supplied at a slow rate to maintain aerobic conditions. The flasks were kept in the dark at 23°C constant temperature.

The NaOH traps and the foam plugs were periodically collected, analyzed, and replaced with fresh NaOH and foam plugs. Analysis for $^{14}CO_2$ in the NaOH traps was by $BaCl_2$ precipitation and by radioassay of the trap samples both before and after $BaCl_2$ treatment. The foam plugs were extracted with ethyl acetate and the extracts were then radioassayed. At 0, 5, 9, 30, 76, 150, 310, 344, 376 days duplicate soil flasks were

extracted twice with 0.5M ammonium formate. The extracts and the extracted and air-dried soils were radioassayed by combustion analysis. Immediately after the radioassay the extracts were neutralized to pH 3-4 to avoid hydrolysis of CMAMP.

A smaller study was conducted to generate degradates for characterization and to study the first three weeks of degradation in detail. The treatment solutions for these smaller studies were the same as the large-scale study except that ^{13}C-sulfosate replaced the non-labeled sulfosate in the preparation of the ^{14}C-sulfosate solution. Otherwise, the method was the same as for the large study except that it was scaled down for convenience.

Reported Results

The half-life was determined to be approximately 2-3 days (see tables). In the large study the extractable residues declined from about 57% of the applied at day 0 to 14% at day 30. Soil bound residues were 40% of the applied initially and declined to 18% at day 30. At day 30 about 60% of the applied was detected as CO_2. No ^{14}C was detected in the foam plugs. Recovery was 91 - 102% for the one year duration of the study.

Identification of residues was made in the small study. CMAMP comprised 78% of the applied at day 0 (97% of the extractable residues) and 8% at day 21. The degradate aminomethylphosphonate (AMP) comprised 0.4% of the applied at day 0 and 15.4% (57% of the extractable residues) at day 21.

Reviewer's Discussion and Interpretation of Study Results

This study adequately demonstrates the aerobic metabolism of the CMAMP moiety of sulfosate. AMP was not qualitatively determined after day 21. However, the extractable ^{14}C residues from the large study declined from 30% of the applied at day 9 to 14% at day 30 and 8% at day 76 indicating that AMP probably increased slightly after day 21 for a short period and then decreased following the rate of decline of the ^{14}C extractable residues (qualitative determinations were not made after day 21).

11. COMPLETION OF ONE-LINER:

12. CBI APPENDIX:

No CBI is included.

Tables for Study 10.1

Sulfosate environmental fate/exposure assessment review

Page _____ is not included in this copy.

Pages 9 through 18 are not included in this copy.

The material not included contains the following type of information:

___ Identity of product inert ingredients

___ Identity of product impurities

___ Description of the product manufacturing process

___ Description of product quality control procedures

___ Identity of the source of product ingredients

___ Sales or other commercial/financial information

___ A draft product label

___ The product confidential statement of formula

___ Information about a pending registration action

X FIFRA registration data

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The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

Experimental Program

State Distribution and Acreage

SC-0224 4-LC

Stauffer proposes that SC-0224 4-LC be tested under a Section 5 Experimental Use Permit program in 41 states. The experimental program will use a maximum of 10,000 pounds active ingredient or 2,500 gallons of SC-0224 4-LC on a maximum of 20,000 acres. It will emphasize the railroad and highway rights-of-way use patterns which will use approximately 50% and 32% of the product, respectively. It is anticipated that these two use patterns will constitute a major part of the SC-0224 4-LC noncrop market. The balance of SC-0224 4-LC will be used for the other proposed use patterns listed in the Experiment Use Permit labeling including general areas, other rights-of-way areas, industrial areas, and other areas.

The program will be conducted on a regional basis by Stauffer Regional Product Development personnel (See Section G - Appendix 1). It should be noted that Wyoming will be handled jointly by the Pacific Northwest and Midwest regions, Tennessee by the Southeast and Southwest regions, and Missouri by the Midwest and Northcentral regions.

Experimental Program
State Distribution and Acreage
for SC-0224 4-LC

REGION	Railroad Rights-of-Way		Highway Rights-of-Way		Other Proposed Uses		Total	
	Pounds	Acres	Pounds	Acres	Pounds	Acres	Pounds	Acres
Midwest (J. W. DiVall)	700	1,400	450	900	400	800	1,550	3,100
Northcentral (K. M. Janzen)	700	1,400	300	600	200	400	1,200	2,400
Northeast (R. R. Libby)	750	1,500	600	1,200	350	700	1,700	3,400
Southeast (J. F. Saylor)	700	1,400	450	900	300	600	1,450	2,900
Southwest (C. R. Andress)	700	1,400	600	1,200	300	600	1,600	3,200
West (E. M. Rose)	700	1,400	300	600	250	500	1,150	2,300
Pacific Northwest (J. F. Saylor)	750	1,500	450	900	150	300	1,350	2,700
TOTAL	4,900	9,800	3,150	6,300	1,950	3,900	10,000	20,000

MIDWEST	Railroad Rights-of-Way		Highway Rights-of-Way		Other Proposed Uses		Total	
	Pounds	Acres	Pounds	Acres	Pounds	Acres	Pounds	Acres
Colorado					50	100	50	100
Iowa					50	100	50	100
Kansas			150	300	50	100	200	400
Minnesota			150	300	50	100	200	400
Nebraska	700	1,400	150	300	50	100	900	1,800
North Dakota					50	100	50	100
South Dakota					100	200	100	200
TOTAL	700	1,400	450	900	400	800	1,550	3,100

NORTH CENTRAL	Railroad Rights-of-Way		Highway Rights-of-Way		Other Proposed Uses		Total	
	Pounds	Acres	Pounds	Acres	Pounds	Acres	Pounds	Acres
Illinois	700	1,400	150	300	50	100	900	1,800
Indiana					50	100	50	100
Michigan					50	100	50	100
Wisconsin			150	300	50	100	200	400
TOTAL	700	1,400	300	600	200	400	1,200	2,400

NORTHEAST	Railroad Rights-of-Way		Highway Rights-of-Way		Other Proposed Uses		Total	
	Pounds	Acres	Pounds	Acres	Pounds	Acres	Pounds	Acres
Connecticut			75	150			75	150
Delaware					100	200	100	200
Kentucky					50	100	50	100
Maine			150	300			150	300
New Jersey					50	100	50	100
New York					50	100	50	100
Ohio			75	150	50	100	125	250
Pennsylvania	700	1,400	150	300	50	100	900	1,800
Virginia			150	300	50	100	200	400
TOTAL	700	1,400	600	1,200	400	800	1,700	3,400

SOUTHEAST	Railroad Rights-of-Way		Highway Rights-of-Way		Other Proposed Uses		Total	
	Pounds	Acres	Pounds	Acres	Pounds	Acres	Pounds	Acres
Alabama					50	100	50	100
Florida	700	1,400	150	300	50	100	900	1,800
Georgia					50	100	50	100
North Carolina			150	300	50	100	200	400
South Carolina					50	100	50	100
Tennessee			150	300	50	100	200	400
TOTAL	700	1,400	450	900	300	600	1,450	2,900

SOUTHWEST	Railroad Rights-of-Way		Highway Rights-of-Way		Other Proposed Uses		Total	
	Pounds	Acres	Pounds	Acres	Pounds	Acres	Pounds	Acres
Arkansas					50	100	50	100
Louisiana			150	300	50	100	200	400
Mississippi					50	100	50	100
New Mexico					50	100	50	100
Oklahoma			150	300	50	100	200	400
Texas	700	1,400	300	600	50	100	1,050	2,100
TOTAL	700	1,400	600	1,200	300	600	1,600	3,200

WEST	Railroad Rights-of-Way		Highway Rights-of-Way		Other Proposed Uses		Total	
	Pounds	Acres	Pounds	Acres	Pounds	Acres	Pounds	Acres
Arizona	700	1,400	150	300	50	100	900	1,800
Nevada			150	300	50	100	200	400
Utah					50	100	50	100
TOTAL	700	1,400	300	600	150	300	1,150	2,300

PACIFIC NORTHWEST	Railroad Rights-of-Way		Highway Rights-of-Way		Other Proposed Uses		Total	
	Pounds	Acres	Pounds	Acres	Pounds	Acres	Pounds	Acres
Idaho					50	100	50	100
Montana			150	300	500	100	200	400
Oregon	350	700			50	100	400	800
Washington	400	800	150	300	50	100	600	1,200
Wyoming			150	300	50	100	200	400
TOTAL	750	1,500	450	900	250	500	1,450	2,900

Sulfosate environmental fate/exposure assessment review

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Pages 28 through 57 are not included in this copy.

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